thereof. For example, the switches may be closed in some other sequence as may be appropriate for a given application without departing from the scope of the present invention. In addition, alternative circuit topologies for the network of tank capacitors and switches may be appropriate. The second terminal of the load may be connected to a potentially variable) voltage other than ground.

It is therefore intended by the appended claims to cover any and all such applications, modifications and embodiments within the scope of the present invention.

Accordingly,

What is claimed is:

1. A system for efficiently charging and discharging a capacitive load from a single voltage source of a first potential consisting of:

a first switch for selectively charging the load;

a second switch for selectively discharging the load;

plural capacitive elements; and

switch means for selectively connecting each of the capacitive elements to the capacitive load to gradually charge or discharge the capacitive load.

2. The invention of claim 1 wherein said switch means includes plural third switches connected between said capacitive elements and said load.

3. The invention of claim 2 wherein said switch means includes means for selectively activating the first, second and third switches.

4. The invention of claim 3 wherein the capacitive load has a first terminal connected to the first switch and a second terminal connected to a source of a second potential.

5. The invention of claim 4 wherein the second switch has a first terminal connected to the first terminal of the load and a second terminal connected to said source of a second potential.

[6. The invention of claim 5 wherein each of the third switches has a first terminal connected to the first terminal of the load and a second terminal connected to a first terminal of an associated one of the plural capacitive elements.]

[7. The invention of claim 6 wherein the means for selectively activating the first, second and third switches includes a finite state machine.]

[8. The invention of claim 7 wherein the finite state machine is designed to receive a clock signal and an input signal and provide selective activation signals for the first, second and third switches in response thereto.]

[9. The invention of claim 8 wherein a second terminal of each of the plural capacitive elements is connected to said source of a second potential.]

[10. The invention of claim 9 wherein each of the capacitive elements has a capacitance which is at least an order of magnitude greater than the capacitance of the load.]

[11. A method for efficiently charging and discharging a capacitive load from a single voltage source including the steps of:

providing a first switch for selectively connecting the voltage source to the load;

providing a second switch for selectively providing a short across the load;

providing plural capacitive elements;

providing plural third switches for selectively connecting each of the capacitive elements to the capacitive load; and

selectively activating the first, second and third switches to gradually charge or discharge the capacitive load.]

12. A system for charging and discharging a capacitive load, comprising:

a first switch to charge the load;

a second switch to discharge the load;

a charge storage element; and

a switch assembly to connect the charge storage element to the capacitive load to gradually charge or discharge the capacitive load.

13. The system of claim 12 wherein said switch assembly includes a third switch connected between said charge storage element and said capacitive load.

14. The system of claim 13 wherein said switch assembly includes means for selectively activating the first, second and third switches.

15. The system of claim 14 wherein the capacitive load has a first terminal connected to the first switch and a second terminal connected to a source of a potential.

16. The system of claim 15 wherein the second switch has a first terminal connected to the first terminal of the capacitive load and a second terminal connected to said source of a potential.

17. The system of claim 16 wherein said third switch has a first terminal connected to the first terminal of the capacitive load and a second terminal connected to a first terminal of said charge storage element.

18. The system of claim 12 wherein said switch assembly includes a finite state machine.

19. The system of claim 13 wherein the finite state machine is designed to receive a clock signal and an input signal and provide selective activation signals for the first, second and third switches in response thereto.

20. The system of claim 19 wherein a second terminal of said charge storage element is connected to said source of a potential.

21. The system of claim 20 wherein a capacitance of said charge storage element is at least an order of magnitude greater than a capacitance of the capacitive load.

22. The system of claim 12, further comprising:

at least two charge storage elements,

such that said switch assembly selectively connects each of said at least two charge storage elements to the capacitive load.

23. The system of claim 12, wherein said charge storage element is a capacitor.

24. The system of claim 12, wherein said switch assembly includes a control circuit.

25. The system of claim 22, wherein said switch assembly includes a control circuit employing a plurality of MOSFETS.

26. A system for charging and discharging a capacitive load from a voltage source comprising:

a first switch to charge the load;

a second switch to discharge the load;

a charge storage element; and

a switch assembly to connect the charge storage element to the capacitive load to charge or discharge the capacitive load in a plurality of steps.

27. A method for charging and discharging a capacitive load from a voltage source comprising the steps of:

charging said capacitive load with said voltage source; and

discharging said capacitive load by connecting said capacitive load through a switch assembly to at least one charge storage element.

28. The method of claim 27, further comprising:

operating said switch assembly to sequentially discharge said capacitive load through at least two charge storage elements.

29. A method for charging and discharging a capacitive load from a voltage source comprising:

charging said capacitive load with said voltage source; and

temporarily storing the charge from said capacitive load for use in a subsequent charging step.

30. A system for charging and discharging a load with a source comprising:

a first lead to charge the load;

a second lead to discharge the load;

a charge storage element; and

a switch to selectively connect the charge storage element to the load.

31. A system for at least one of charging and discharging a capacitive load comprising:

a charge storage device; and

a first switching device operable to selectively couple the charge storage device to the capacitive load during at least one of a charging and a discharging of the capacitive load.

32. The system of claim 31, wherein the first switching device is operable to selectively couple the charge storage device to the capacitive load during both the charging and the discharging of the capacitive load.

33. The system of claim 31, wherein the charge storage device includes a capacitor.

34. The system of claim 33, wherein a capacitance of the capacitor is greater than a capacitance of the capacitive load.

35. The system of claim 31, wherein the first switching device includes a MOSFET.

36. The system of claim 31, wherein the selective coupling of the charge storage device to the capacitive load causes at least one of the charging and the discharging of the capacitive load to occur in a plurality of steps.

37. The system of claim 31, further comprising:

a second switching device operable to selectively couple the capacitive load to a voltage source; and

a third switching device operable to selectively provide a short across the capacitive load.

38. A system for at least one of charging and discharging a capacitive load comprising:

a plurality of charge storage devices; and

a first switching device operable to selectively couple the plurality of charge storage devices to the capacitive load during at least one of a charging and a discharging of the capacitive load.

39. The system of claim 38, wherein the first switching device includes a plurality of MOSFETs.

40. The system of claim 38, wherein the first switching device is operable to selectively couple the plurality of charge storage devices to the capacitive load during both the charging and the discharging of the capacitive load.

41. The system of claim 38, wherein each of the plurality of charge storage devices includes a capacitor.

42. The system of claim 41, wherein a capacitance of the capacitor is greater than a capacitance of the capacitive load.

43. The system of claim 38, wherein the selective coupling of the plurality of charge storage devices to the capacitive load causes at least one of the charging and the discharging of the capacitive load to occur in a plurality of steps.

44. The system of claim 38, comprising:

a second switching device operable to selectively couple the capacitive load to a voltage source; and

a third switching device operable to selectively provide a short across the capacitive load.

45. A method for at least one of charging and discharging a capacitive load comprising the step of:

selectively coupling a charge storage device to the capacitive load to cause at least one of the charging and the discharging of the capacitive load to occur in a plurality of steps.

46. A method for charging and discharging a capacitive load comprising the steps of:

charging the capacitive load;

discharging the capacitive load; and

storing at least a portion of a charge discharged during the discharging step for use in a subsequent charging step.